1901MNRAS..61..473B

*Additional Note on the Position of Nova Persei, and a Comparison of Photographic Magnitudes of Neighbouring Stars with those of Fr. Hagen's Chart and Catalogue.** By F. A. Bellamy, F.R.Met.Soc.

In a former paper (*Monthly Notices*, lxi. p. 340) the position of the *Nova* and comparison stars were based upon the 31 stars in the Bonn A.G. Catalogue +40° to +50° reduced to epoch 1900·0. It will be seen on reference to Table I. (p. 341) that two stars 2972 and 2983 have rather large residuals in R.A., $+0^{s}{\cdot}55$ and $+0^{s}{\cdot}33$ respectively. These quantities being of the same sign and both the stars coming into the same sides of the equations, east and south halves of the plate, I thought the plate constants might be improved by omitting these two stars, and accordingly obtained these four equations (the computations of ξ' and η' of the Bonn stars, and the means of the Oxford measures being carried to the fourth decimal of the réseau intervals):

$$\begin{array}{lrcr}
 & & x-\xi' & & y-\eta' \\
\text{West half} & 8{\cdot}4362a + 13{\cdot}7498b + c = & +1{\cdot}2725 & & +1{\cdot}4199 \\
\text{East half} & 18{\cdot}3311a + 13{\cdot}7823b + c = & +1{\cdot}2671 & \text{and} & +1{\cdot}4723 \\
\text{North half} & 13{\cdot}0493a + 18{\cdot}6997b + c = & +1{\cdot}2444 & & +1{\cdot}4426 \\
\text{South half} & 13{\cdot}3658a + 9{\cdot}1601b + c = & +1{\cdot}2936 & & +1{\cdot}4476
\end{array} \quad \ldots \quad (A)$$

When solved in the usual way the following constants for plate 1728 are obtained:

a	b	c	d	e	f
−·00053	−·00518	+1·3482	+·00530	−·00035	+1·3800

and the position of the *Nova* becomes

	h	m	s		°	′	″	ξ	η
R.A. 1900·0	3	24	24·160	Dec.	+43	33	42·45	−1·7920	−5·2585

The declination of the *Nova* (*Monthly Notices*, lxi. p. 342) should have been given as +43° 33′ 42″·51; an error ($0^{r.i.}{\cdot}010$) was made in the very last step of the calculations; the whole of the work has been re-examined, but no other error found. In the former paper the plate constants were obtained with the inclusion of these two stars; for comparison, the equations, constants, and position of the *Nova* are here given.

---

* Georgetown College Observatory, Washington, 2nd Catalogue and Chart of *Nova Persei* stars.

1901MNRAS..61..473B

$$\begin{array}{lrcl}
 & & x-\xi' & y-\eta'. \\
\text{West half} & 8{\cdot}436a+13{\cdot}749b+c= & +1{\cdot}2723 & +1{\cdot}4199 \\
\text{East half} & 18{\cdot}010a+12{\cdot}932b+c= & +1{\cdot}2740 & +1{\cdot}4707 \\
\text{North half} & 13{\cdot}049a+18{\cdot}699b+c= & +1{\cdot}2443 & +1{\cdot}4427 \\
\text{South half} & 13{\cdot}648a+\ 8{\cdot}904b+c= & +1{\cdot}2969 & +1{\cdot}4489
\end{array}
\quad \text{and} \quad \ldots \quad (B)$$

a	*b*	*c*	*d*	*e*	*f*
·00031	−·00539	+1·3491	+·00528	−·00031	+1·3797

	h m s	° ′ ″	*ξ*	*η*
Nova 1900·0	3 24 24·12	+43 33 42·3	−1·794	−5·259

The differences, $x-\xi'$ and $y-\eta'$, were entered to the third decimal place for each star, the means of groups being carried to the fourth place. As it might be considered by some that this was insufficiently accurate, I have reformed the equations, entering the x, y, $x-\xi'$, and $y-\eta'$ quantities to the fourth place throughout, and they become

$$\begin{array}{lrcl}
\text{West half} & 8{\cdot}4362a+13{\cdot}7498b+c= & +1{\cdot}2725 & +1{\cdot}4199 \\
\text{East half} & 18{\cdot}0100a+12{\cdot}9323b+c= & +1{\cdot}2740 & +1{\cdot}4706 \\
\text{North half} & 13{\cdot}0493a+18{\cdot}6997b+c= & +1{\cdot}2444 & +1{\cdot}4426 \\
\text{South half} & 13{\cdot}6477a+\ 8{\cdot}9039b+c= & +1{\cdot}2970 & +1{\cdot}4490
\end{array}
\quad \text{and} \quad \ldots \quad (C)$$

The constants found from these are almost identical with (B).

a	*b*	*c*	*d*	*e*	*f*
−·00033	−·00539	+1·3495	+·00527	−·00033	+1·3800

	h m s	° ′ ″	*ξ*	*η*
Nova 1900·0	3 24 24·122	+43 33 42·51	−1·7939	−5·2583

A comparison of (B) and (C) seems to show that no sensible increase in accuracy is obtained by extending the calculations to the fourth place of decimals, *which more than doubles the expenditure of time.* A considerably greater change might be made in the constants by the inclusion or omission of a single comparison star (*étoile de repère*) as in (A). This evidence may be of interest to those engaged in the Astrographic Survey.

Passing on to the consideration of the measures of another plate 1732 taken, as before, with the Astrographic Telescope on 1901 March 5 between Oxford sidereal time $6^h\ 24^m\ 40^s$ and $6^h\ 32^m\ 10^s$ with exposures of 1^m, 1^m, 1^m, I will state briefly that each exposure of the thirty-three Bonn stars was measured in D- and R-positions by myself, and the means of these six bisections were taken to four places of decimals; they were then compared with the Oxford standard coordinates ξ' and η' given in Table I. (*Monthly Notices*, lxi. p. 341), the equations formed and solved in the usual way—the two stars 2972 and 2983 being omitted—and the separate stars were corrected for these constants.

In the case of the *Nova*, the diameter of the photographic

1901MNRAS..61..473B

image being 30″, three independent bisections of each exposure were made in D- and R-positions of the plate in the measuring instrument, and, similarly, a pair of contact measures were obtained; the means of the eighteen bisections and thirty-six contacts in x and y are

x		y	
Bisections.	Contacts.	Bisections.	Contacts.
r.i.	r.i.	r.i.	r.i.
12·7493	12·7491	9·2708	9·2707

With a view to ascertain if there were any personality in the measurement of large images, *Nova* on this plate was measured in a similar manner by Messrs. H. F. Mullis, B. Gray, and E. A. Gray, with these results:

	x		y	
	Bisections.	Contacts.	Bisections.	Contacts.
H.F.M.	12·7487	12·7499	9·2708	9·2706
B.G.	12·7495	12·7498	9·2692	9·2707
E.A.G.	12·7479	12·7489	9·2698	9·2717

The personality, if any, is very small.

The means in x are 12·7489 for bisections and 12·7494 for contacts, and in y 9·2702 for bisections and 12·2709 for contacts. The equations for plate 1732 are:

$$\begin{array}{lrcl}
 & & x-\xi' & & y-\eta' \\
\text{West half} & 8{\cdot}2366a + 13{\cdot}8810b + c = & +1{\cdot}0728 & \left.\begin{array}{l}\\ \\ \\ \\ \end{array}\right\} \text{ and } \left\{\begin{array}{l}\\ \\ \\ \\ \end{array}\right. & +1{\cdot}5512 \\
\text{East half} & 18{\cdot}1309a + 13{\cdot}8117b + c = & +1{\cdot}0689 & & +1{\cdot}5017 \\
\text{North half} & 12{\cdot}8994a + 18{\cdot}7832b + c = & +1{\cdot}0943 & & +1{\cdot}5262 \\
\text{South half} & 13{\cdot}1193a + 9{\cdot}2411b + c = & +1{\cdot}0491 & & +1{\cdot}5283
\end{array}$$

The constants obtained are

a	b	c	d	e	
−·00036	+·00473	+1·0101	−·00500	−·00033	+1·5969

Taking the means of the measures, 216, each in x and y, made by the four measurers, and correcting them for these constants, we get $11^{\mathrm{r.i.}}{\cdot}6998$ for ξ' and $7^{\mathrm{r.i.}}{\cdot}7404$ for η', which, converted into R.A. and Dec., give positions for *Nova* for 1900·0:

	h	m	s		°	′	″	ξ	η
R.A.	3	24	24·116	Dec.	+43	33	41·79	−1·3002	−5·2596

By using the same constants for correcting the mean measures of the Bonn stars this table is formed:

1901MNRAS..61..473B

TABLE I.

Bonn. A.G.C.	Residuals.				Bonn. A G.C.	Residuals.			
	x		y			x		y	
	r.i.	″	r.i.	″		r.i.	″	r.i.	″
2883	·0000	·00	−·0001	−·03	2970	−·0004	−·12	+·0003	+·09
2892	+·0003	+·09	+·0005	+·15	2971	+·0005	+·15	+·0009	+·27
2895	+·0007	+·21	+·0009	+·27	2973	+·0005	+·15	+·0010	+·30
2898	+·0012	+·36	−·0007	−·21	2979	−·0015	−·45	−·0002	−·06
2899	+·0023	+·69	+·0003	+·09	2982	+·0008	+·24	+·0003	+·09
2906	−·0007	−·21	−·0007	−·21	2986	−·0002	−·06	−·0005	−·15
2907	−·0002	−·06	−·0002	−·06	2996	−·0008	−·24	−·0006	−·18
2911	+·0006	+·18	+·0005	+·15	3004	−·0010	−·30	−·0002	−·06
2913	−·0004	−·12	+·0006	+·18	3008	+·0012	+·36	+·0002	+·06
2919	−·0015	−·45	·0000	·00	3009	+·0017	+·51	+·0009	+·27
2944	−·0004	−·12	·0000	·00	3016	−·0015	−·45	·0000	·00
2948	+·0010	+·30	+·0022	+·66	3021	−·0009	−·27	−·0010	−·30
2953	−·0008	−·24	−·0008	−·24	3034	−·0004	−·12	−·0003	−·09
2956	+·0008	+·24	−·0019	−·57	2972	−·0011	−·33	−·0011	−·33
2964	−·0023	−·69	−·0010	−·30	2983	+·0010	+·30	+·0008	+·24
2968	+·0024	+·72	−·0005	−·15					

This table is instructive, as the quantities given are really the differences in the measured positions of the same stars on two plates, and contain all errors in bisections, determination of plate constants, and in the reductions. It may be noticed that the maximum difference in x is less than three quarters of a second of arc, and that there are not more than four stars with differences exceeding half of a second of arc; in the y coordinate there are two instances above a third of a second of arc, but the differences are generally smaller; the mean difference in x without regard to sign is 0″·279, and in y 0″·188. With regard to the last two stars, which have not been included in the reductions, the rather large differences as indicated in the former paper disappear, and those differences cannot be in the measures, but must be either in the Bonn positions or caused by proper motions.

For convenience the places of the *Nova* may be repeated here.

	R.A. 1900·0 h m s	Decl. 1900·0 ° ′ ″
1901 Feb. 25	3 24 24·160	+43 33 42·51
1901 March 5	24·116	41·79

Comparison of Photographic and Visual Magnitudes.

In the former paper no attempt was made to determine the magnitudes of the 159 stars on Argelander or any definite scale, the measured diameter only being given. Since that paper was written Fr. Hagen, of Georgetown College Observatory, has published a second chart and catalogue of faint stars for com-

1901MNRAS..61..473B

parison with *Nova* if it should fall below the 7th to the 13th magnitude. In order to ascertain whether all the stars in Fr. Hagen's second catalogue are on plate 1728, and also to gain some information of the estimated as compared with the photographic magnitude, expressed in thousandths of a réseau interval (300″), I have compared the stars in his catalogue with those places obtained from plate 1728, and give the comparison in Table II. Stars No. 1 to 10, 12 to 16, 19, 23, 25–28, 30, 33, 35, 39, 40 are outside the area included in the former Table II. (p. 343).

In making the comparison the position of *Nova* has been taken as $3^h\ 24^m\ 24^s$ +43° 33′ 42″.

TABLE II.

B.D. No.	Hagen. No.	Oxford. No.	H. Mag.	O. Mag.	Difference. O−H. R.A.	Difference. O−H. Dec.	B.D. No.	Hagen. No.	Oxford. No.	H. Mag.	O. Mag.	Difference. O−H. R.A.	Difference. O−H. Dec.
°					s	″	°					s	″
43·734	36	5	9·6	12	− ·5	+43		75	80*a*	12·5	3	− ·7	+10
	43	23	10·2	12	− ·4	+ 6		76	80*b*	12·6	4	− ·3	+14
	45	27	10·4	11	+ ·3	+ 0		74	81*a*	12·4	7	− ·8	+ 2
	46	30	10·7	11	− ·4	+ 1	43·741	29	85	9·2	14	+2·2	+23
	52	31	11·2	8	+ ·3	+ 3		50	89	11·1	7	+ ·2	− 5
	51	32*b*	11·2	11	·0	+ 5		71	89*a*	12·3	5	+5·2	+ 3
43·735	34	37	9·6	12	+ ·2	+ 2		66	90	11·9	6	− ·1	− 6
	61	39	11·7	8	+ ·1	+ 5		68	91	12·1	8	−1·1	− 3
	67	40*a*	12·0	5	·0	0		42	92	10·1	12	+ ·6	− 3
	60	42	11·7	9	+ ·3	−18		55	93*a*	11·4	7	+ ·7	+ 9
	63	44	11·9	7	− ·3	− 2	43·743	32	94	9·4	14	+ ·2	− 8
43·737	38	48	9·8	11	+ ·3	− 7		65	93*b*	11·9	5	+ ·6	− 2
	58	50	11·6	7	+ ·1	− 2	43·744	11	98	8·4	24	+ ·9	+ 1
	64	51	11·9	7	+ ·1	+12		47	101	10·7	10	− ·4	−16
	53	55*a*	11·3	9	+ ·7	−10		48	103	10·8	10	·0	+16
43·738	37	57	9·7	9	+ ·6	−16		72	107*a*	12·4	3	−1·1	−13
	49	59	11·0	10	·0	+ 1	43·746	18	108	8·8	20	− ·3	+23
43·739	20	61	8·9	23	+ ·2	+ 1		70	109	12·1	7	·0	− 1
	54	62	11·4	8	+ ·6	− 1		59	111	11·6	8	+ ·4	+ 3
	56	64	11·4	10	−1·6	−23	43·748	24	127	9·0	23	+ ·2	− 4
	57	67*a*	11·6	8	− ·7	+72	43·749	21	132	9·0	15	+ ·2	− 1
43·740	17	68	8·8	21	+ ·6	− 2	43·750	41	137	10·0	14	+ ·2	−18
	44	71	10·3	11	+ ·2	+14	43·751	22	142	9·0	22	− ·3	− 3
	62	73	11·8	8	− ·4	−68	43·752	31	148	9·3	19	+ ·3	+25

Notes.

Hagen No. 29. The difference is rather large; there is a very faint star 4^s preceding, and 45″ north.

1901MNRAS..61..473B

No. 51. Only the second exposure measured; the third exposure falls on the réseau line and is invisible.

Nos. 57, 62. No other stars are visible on the plate that would agree more closely.

No. 64. The sign of $\Delta\alpha$ should be *minus*; the chart is correct. A notification of this I have already communicated to the *Astronomische Nachrichten*.

No. 71. Extremely faint, just a trace of the second image; possibly Oxford 89*a* is another star, the other being too faint.

No. 72. Extremely faint, no trace of the second image.

No. 73. If the third and longest exposure is on the plate its place would be on a réseau line; second exposure invisible.

No. 77. Can find nothing to agree with this.

Nos. 74, 75. The second images barely visible, but were not measured; mag. of No. 74 not measured, very diffused image, not like a star; the latter is within the discoloured part of the plate caused by the brightness of *Nova*.

Nos. 69, 78, 79, 80, 81. These are too close to the *Nova* to be seen on the plate, and probably too faint.

The positions of faint stars within 3′ of *Nova* have been determined with the 36-in. telescope at the Lick Observatory (*Publications of the Astron. Soc. of the Pacific*, vol. xiii. p. 65).

As several stars could not be identified with certainty or were not previously measured on the plate, it was examined under the most favourable conditions as to light, and by knowing the positions in which to look for very faint stars. The result of this scrutiny is that every instance of doubt has been removed, except in the case of Hagen's Nos. 71, 73, 77. The identification has not been at all easy owing to other stars being within reasonably close agreement for approximate positions. Father Hagen says his places may be in error by 1^s in R.A. and 36″ in Dec. After some months' experience in comparing Oxford astrographic plates with B.D. stars, the magnitude of the differences, and the frequent uncertainty in deciding which amongst the numerous photographed stars to compare it with, one comes to the conclusion that we are getting too many stars to deal with unless accurate positions are determined; otherwise erroneous identifications will be made.

Nearly all the stars omitted before and now given in this paper (Table III.) are barely visible on the plate, and would easily be overlooked for the reasons just mentioned. For the astrographic work the measurers are generally instructed to pass by and not spend time over any very faint objects which do not show the second image obviously; we are seldom troubled with an insufficiency of stars on our plates, and it seems the better plan to omit doubtful images of stars (? spots in the film) rather than record a large number of spurious places of stars and create perplexities for the future.

The positions of the additional stars with the catalogue number are as below (Table III.).

1901MNRAS..61..473B

TABLE III.

Hagen No.	Ref. No.		Oxford Measured Mag.	ξ′ 1900·0.	η′ 1900·0.	Deduced. R.A. 1900·0. h	m	s	N. Dec. 1900. °	′	″
	16	*a*	6	7·9564	5·6120	3	22	41·22	43	22	58·4
	20	*a*	5	8·2234	5·9673		22	48·50		24	46·9
	32	*a*	5	8·7893	5·7607		23	4·11		23	44·6
51	32	*b*	11	8·9069	8·3660		23	6·95		36	46·5
67	40	*a*	5	9·5845	6·0859		23	25·95		25	23·5
53	55	*a*	9	10·5353	10·8429		23	51·74		47	55·5
57	67	*a*	8	11·4580	10·2804		24	17·29		46	23·6
75	80	*a*	3	12·2855	5·3735		24	40·34		21	52·0
76	80	*b*	4	12·4079	5·5451		24	43·71		22	43·5
74	81	*a*	7	12·4265	8·0682		24	44·16		35	20·4
	84	*a*	6	12·6477	11·8462		24	50·15		54	13·8
71?	89	*a*	5	12·8203	6·1291		24	55·16		25	38·8
55	93	*a*	7	13·0268	4·8882		25	0·74		19	26·6
65	93	*b*	5	13·2379	8·6942		25	6·57		38	28·3
	96	*a*	7	13·3804	8·4747		25	10·51		37	22·4
72	107	*a*	3	14·1583	5·6918		25	31·88		23	47·4

As the ordinary photographic plate is not adapted for orange or red coloured stars, it is reasonable to suppose that they would not be on plate 1728, at least if fainter than about the tenth magnitude; this would not tend to agreement in visual and photographic magnitudes.

Grouping the magnitudes in Table II., the following results are obtained for this plate:

TABLE IV.

Limit of Magnitude.	Hagen Mean Mag.	Oxford. Plate 1728.	No. of Stars.
6·5 – 6·9	6·7	33	2
7·0 – 7·4	7·2	36	1
7·5 – 7·9	7·7	32	3
8·0 – 8·4	8·4	25	4
8·5 – 8·9	8·8	21	12
9·0 – 9·4	9·1	18	18
9·5 – 9·9	9·7	11	4
10·0 – 10·4	10·2	12	5
10·5 – 10·9	10·7	10·3	3
11·0 – 11·4	11·2	8·6	7
11·5 – 11·9	11·7	7·7	11
12·0 – 12·4	12·2	5·6	5
12·5 – 12·9	12·6	3·5	2

1901MNRAS..61..473B

From which may be derived this *approximate* scale for interpreting the photographic magnitudes given for plate 1728.

Mag.	7·0	7·5	8·0	8·5	9·0	9·5	10·0	10·5	11·2	11·9	12·2	12·6	13·0
Oxford diameter	35	33	29	24	20	15	13	11	9	7	6	5	4

Estimations of Magnitude.

March 25, 7^{h}. This evening being brilliantly fine, I watched for and noted the time of the first appearance to the eye of some stars of similar magnitude near the *Nova*. At $7^{h}\ 24^{m}$ G.M.T. saw ν (3·9 mag.); $7^{h}\ 28^{m}$ ι appeared (4·2); $7^{h}\ 31^{m}$ Hagen No. 26 and 27 (5·3 and 5·1) were seen, probably as combined light; $7^{h}\ 32^{m}$ *Nova* was seen; *l* (5·1) appeared some minutes before *Nova*. At 8^{h} *Nova* estimated as $\frac{1}{2}$ magnitude fainter than *l*. Difference in colour would affect such observations.

March 26, 9^{h}. Sky very clear, moonlight; *Nova* = ι and σ *Persei* and $\frac{1}{2}$ magnitude fainter than κ.

April 10. *Nova* intensely red (crimson).

University Observatory, Oxford :
1901 *May* 9.

Further Observations of the New Star in Perseus (3).

By A. Stanley Williams.

The following paper contains a further list of observations of the brightness of *Nova Persei* in the same form as the last one. As, however, the faintness of the star soon rendered greater optical aid necessary, a column has been added to indicate the instrument used. In this Op. signifies opera glass, $\frac{3}{4}$ in. the $\frac{3}{4}$-inch finder attached to a $2\frac{3}{4}$-inch refractor, and $2\frac{3}{4}$ in. the latter instrument itself, with a power of 35. The observations were much hindered by cloud in the early part of April, but the latter half of the month fortunately proved very fine.

Date. 1901.		Greenwich M.T. h	m	Observations.	Mag.	Inst.
Apr.	12	9	35	κ Persei + 5, 32 Per. −1, 36 Per. − 5	4·7	Op.
	13	10	20	κ Per. + 2, 32 Per. −6, 36 Per. − 8	4·35	,,
	14	8	30	κ Per. +12, 32 Per. +5, 36 Per. + 1	5·35	,,
		10	10	32 Per. + 4, 36 Per. −2	5·2	,,
	15	9	35	32 Per. + 6, 36 Per. +1	5·45	,,
		10	5	36 Per. + 2, 30 Per. +1	5·55	,,
	17	9	45	32 Per. + 2, 36 Per. −3	5·05	,,
	19	9	45	32 Per. + 5, 30 Per. −1, =36 Per.	5·35	,,
	20	9	40	32 Per. + 6, 30 Per. +1, =36 Per.	5·45	,,
	21	8	50	36 Per. + 3, 30 Per. +2, = *a*	5·9	,,
				36 Per. + 7, = *a*	6·3	$\frac{3}{4}$ in.
				36 Per. + 8, *a* + 2 (see note)	6·25	$2\frac{3}{4}$ in.
		10	0	36 Per. + 2, 30 Per. +2, *a* − 2	5·8	Op.